

and the residue was dissolved in boiling glacial acetic acid; the solution on standing deposited small crystalline grains, the ethereal solution of which showed the absorption spectrum of acetylphyllotaonin. Another portion of the residue left on evaporation of the ethereal solution was dissolved in boiling alcoholic potash; the solution, after filtration and addition of water, was acidified with acetic acid and then shaken up with ether; an ethereal solution was obtained showing the characteristic absorption spectrum of phyllotaonin.

The experiments just described proving the convertibility of phylloxanthin into phyllocyanin, tend to support the view held by some observers that only one chlorophyll really exists, and that there are not two or more chlorophylls as has sometimes been maintained. Under the action of acids, chlorophyll yields phylloxanthin, which is then converted into phyllocyanin. The latter when treated with alkalis gives phyllotaonin, and this, by the more energetic action of alkalis at a higher temperature, yields phylloporphyrin. The progressive increase in the number of absorption bands in passing through this series, and the gradual shifting of the bands from the red to the blue end of the spectrum, are points worthy of notice.

III. "On the Ratio of the Specific Heats of some Compound Gases." By J. W. CAPSTICK, D.Sc., M.A., Fellow of Trinity College, Cambridge. Communicated by Professor J. J. THOMSON, F.R.S. Received January 25, 1895.

(Abstract.)

The experiments described are a continuation of those of which an account was given in the 'Philosophical Transactions,' vol. 185, p. 1.

The apparatus and method of procedure were the same as were described in the former paper. Kundt's dust-figure method was used for finding the velocity of sound in the gas, and the ratio of the specific heats was calculated by means of the formula

$$\gamma = 1.408 \times \rho \times \left(\frac{l}{l'} \right) \left\{ 1 + \frac{1}{p} \frac{d}{dv} (pv) \right\},$$

the last factor being added to the ordinary formula in order to correct for the deviation of the gas from Boyle's law.

The densities and isothermal curves were determined experimentally.

The results are as follows:—

| Name. | Formula. | γ . |
|-----------------------------|-----------------------------------|------------|
| Methylene chloride | CH_2Cl_2 | 1·219 |
| Chloroform | CHCl_3 | 1·154 |
| Carbon tetrachloride | CCl_4 | 1·130 |
| Ethylene chloride | $\text{C}_2\text{H}_4\text{Cl}_2$ | 1·137 |
| Ethylidene chloride | $\text{C}_2\text{H}_4\text{Cl}_2$ | 1·134 |
| Ethylene | C_2H_4 | 1·264 |
| Vinyl bromide | $\text{C}_2\text{H}_3\text{Br}$ | 1·198 |
| Allyl chloride | $\text{C}_3\text{H}_5\text{Cl}$ | 1·137 |
| Allyl bromide | $\text{C}_3\text{H}_5\text{Br}$ | 1·145 |
| Ethyl formate | HCOOC_2H_5 | 1·124 |
| Methyl acetate | $\text{CH}_3\text{COOCH}_3$ | 1·137 |
| Sulphuretted hydrogen | SH_2 | 1·340 |
| Carbon dioxide | CO_2 | 1·308 |
| Carbon disulphide | CS_2 | 1·239 |
| Silicon tetrachloride | CCl_4 | 1·129 |

From these and the results given in the former paper it is shown that corresponding halogen derivatives of the same hydrocarbon have the same γ , the statement being no longer restricted to the monohalogen derivatives of the paraffins.

The equality of the γ 's of the two dichlorethanes, and of methyl acetate and ethyl formate, shows that the previously investigated case of the two propyl chlorides does not stand alone, but that it is probably true that isomeric bodies in general have the same γ .

From the results for the substitution products of methane and ethane with more than one halogen in the molecule it is shown that, whether the first chlorine introduced into the molecule alters the value of γ or not, each chlorine after the first causes a fall in γ .

SiCl_4 has the same γ as CCl_4 . SH_2 has nearly the same γ as some observers have found for OH_2 , but CO_2 and CS_2 differ widely, whence it follows that, just as in the case of hydrogen and chlorine, the possibility of interchange of oxygen and sulphur without altering γ does not extend to the substitution of two atoms of sulphur for two of oxygen.

In the paper a proof is given of the formula

$$\beta + 1 = \frac{\frac{2}{3} + \frac{1}{p} \frac{d}{dv} (pv)}{\gamma - 1}$$

for calculating β , the ratio of the rates of increase of intramolecular energy and translational energy of the molecule on a rise of temperature, and the constant β is given for the gases investigated.

It is shown that $\frac{\beta + 1}{n}$ is constant for the paraffins and their mono-

halogen derivatives, whence it follows that for these the ratio of the increase of mean total energy to the increase of kinetic energy of translation of the molecule is proportional to the number of atoms in the molecule.

IV. "An Instrument for Cutting, Grinding, and Polishing Section-plates and Prisms of Mineral or other Crystals Accurately in the Desired Directions." By A. E. TUTTON, Assoc. R.C.S., Demonstrator of Chemistry at the Royal College of Science, South Kensington. Communicated by Professor JUDD, F.R.S. Received November 28, 1894.

(Abstract.)

In a recent communication ('Phil. Trans.,' 1894, Series A, p. 887; 'Roy. Soc. Proc.,' vol. 55, p. 108) the author described an instrument for grinding accurately orientated section-plates and prisms of crystals of artificial preparations. The success of that instrument is so complete that another instrument has been devised and constructed, upon similar principles, but with the necessary modifications and additions, to enable equally accurately orientated plates or prisms to be prepared from the relatively harder crystals of natural minerals.

The new instrument is constructed upon a scale one-fifth larger than the former one as regards such parts as are fundamentally similar, to confer greater strength. The main innovations are those of a cutting apparatus, capable of ready removal, in order not to impede goniometrical, grinding, and polishing operations, and a much larger grinding table fitted with a particularly convenient mode of attachment for any one of nine interchangeable grinding and polishing laps, suitable for use with crystals of every degree of hardness. The accompanying illustration represents the lower portion of the instrument, drawn from a point sufficiently high above the base to most clearly exhibit the arrangement of the cutting apparatus. The instrument is not intended to replace the one previously described, which is fully adapted to all the uses of chemical crystallographers, and the cost of which is only two-thirds that of the one now described. It is intended especially for the use of mineralogists, but, naturally, will likewise serve all the purposes of the smaller instrument.

The mode of supporting the outer fixed cone within which the movable axes rotate, the construction of the circle and its axis and fine adjustment, and of the gun-metal axis and its counterpoising levers designed for controlling the pressure between crystal and lap, as also of the inner steel axis from which are suspended the crystal α